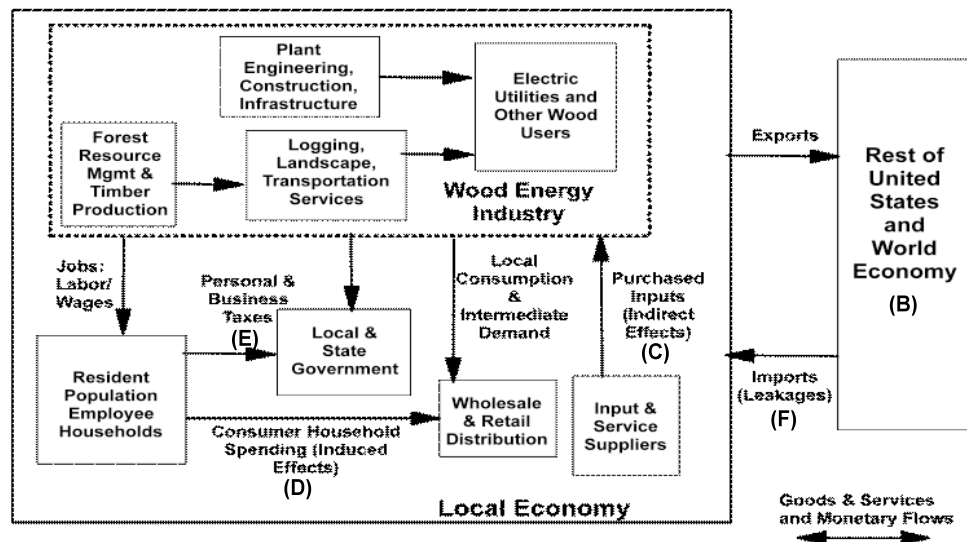




Economic Impacts of using Woody Biofuels in North Carolina

North Carolina has a vast sustainable woody biomass resource that could be used to offset much of the fuel imported into our state. Woody biomass can be used for small- to medium-scale power plants instead of or along with fossil fuels. Connecting these to the “grid” reduces dependency on centralized large scale electric generation facilities, benefitting local resources, retaining money locally, and reducing pollution and carbon emissions. While these facilities are costly investments with an initial financial burden to the community, they significantly benefit local economies by providing new opportunities for forest landowners and creating diverse local jobs. NC policy makers, industry leaders and the public at large should research the feasibility of a facility in their communities. This publication provides a synopsis of the basic information about local economic benefits and impacts local woody biomass energy generates from a larger southeastern project. (For more details on the project refer to Hodges and Rahmani, 2007.)



NC Woody Biomass
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Figure 1. Structure and economic impacts of wood-fueled electric power generation in a local economy.

Maintaining Local Economies – A General Model

Figure 1 illustrates a woody biomass energy sector and its linkages to the local economy. Timber growers, loggers, and electric power producers sell their products and services to consumers within the local (A) and external (B) economies through wholesale and retail distributors. Inputs and services from local suppliers to the wood biomass energy sector re-circulate money in the local economy (C). Employees of the wood biomass energy sector spend their earnings locally on food, clothing,

housing, and transportation, further increasing local economic activity (D). Businesses and households pay taxes to local governments (E). Money always leaves local economies for goods and services not available locally, outside investments or federal taxes (F); this is known as “leakage.” Using local raw materials for energy production instead of importing fossil fuels from other states decreases leakage and bolsters the local economy.

Community Economic Impact Examples

Ways that local economies are affected by development of a biomass energy facility will vary widely depending on the community economic structure. Two counties in North Carolina, Buncombe, a mountain county, and Orange, a piedmont county, provide examples of these effects. Both are well suited for some level of a woody biomass energy production. A comparison of two

Table 1. Typical *Capital* Costs for a 20 or 40 MW Wood-Fired Power Plant

Expense Description	20 MW (\$1000)	40 MW (\$1000)
Site preparation (heavy industrial)	800	1,000
Water, sewer, and pipeline construction	100	150
Power boiler, heat exchangers, turbine and generator set manufacturing	44,500	81,000
Initial fuel delivery (trucks)	300	500
Financing cost (Funds, trusts, and other financial vehicles)	1,500	2,500
Site acquisition (Real estate)	1,000	1,000
Permitting (Environmental and other technical consulting)	500	600
Total	48,700	86,750

Table 2. Typical *Annual* Operating Costs (1st Year) for a 20 or 40 MW Wood-Fired Power Plant

Expense Description	20 MW (\$1000)	40 MW (\$1000)
Wood fuel cost (logging, ag. & forestry support services)	4,409	9,827
Utility interconnection	100	155
Start up fuel-gas (natural gas)	25	50
Utilities-electric	50	75
Consumable chemicals	330	660
Power boiler and heat exchanger maintenance	50	90
Turbine and generator set maintenance	50	90
Insurance	160	260
Mobil equipment lease	90	120
Other routine and periodic maintenance	1,000	1,650
Environmental costs	100	160
Management overhead	100	120
Office expenses	110	140
Ash disposal	60	120
Property tax	470	800
Salaries and benefits (Value added)	1,260	1,820
Total Operating Costs	7,964	16,137

levels of development (20 and 40 megawatt (MW) power plants) for these counties provides projections of direct and indirect economic impacts. Fuel-stock for these plants were county-wide estimations of urban wood wastes, logging residues, and pulpwood harvest rather than harvesting timber solely for biomass energy. (See Langholz, 2007 for more details on the economic analysis inputs)

Estimated costs of construction (Table 1) and the generated economic impact (Table 3, top) occur only one year. Site acquisition and construction costs are valued at \$48.7 million (20 MW plant) and \$86.8 (40 MW plant). Annual operating costs (Table 2), and economic impacts generated from plant operations (Table 3, bottom) recur annually.

\$9.8 million for the 20 or 40 MW plants, respectively, representing 55% and 61% of annual costs.

Capital Construction Impacts

The estimated economic impacts resulting from the construction phase of power plant development in each of the counties are summarized in Table 3 (top). Total output impacts for a 20 MW power plant ranged from \$7.9 million (Buncombe) to \$45.3 million (Orange). This impact includes all of the purchases (such as food, clothing, and gasoline) that people are able to make because their wages are tied to the power plant (Box 1). Employment impacted varied from 74 to 379 jobs; however, some of these

Table 3. Capital Construction and First Year Annual Operating Impacts for a 20 or 40 MW Wood-Fueled Power Plant in Buncombe and Orange Counties, North Carolina.

County	20 MW Plant			40 MW Plant		
	Output (\$1,000,000)	Jobs	Value Added (\$1,000,000)	Output (\$1,000,000)	Jobs	Value Added (\$1,000,000)
Construction Impacts						
Buncombe	7.89	74	3.90	10.72	98	5.06
Orange	45.27	379	25.95	78.73	653	44.88
Annual Operation Impacts (First Year)						
Buncombe	12.84	242	7.59	26.65	546	15.77
Orange	10.81	177	6.91	22.08	393	14.07

Total annual operating expenses (first year) for a wood-fueled power plant averaged \$8.0 million for 20 MW and \$16.1 million for 40 MW. Wood fuel typically represents the largest operating cost for a facility. These costs varied significantly across the selected counties due to differences in availability of forest and wood waste resources and transportation infrastructure. Fuel costs averaged \$4.4 and

jobs were a result of the increased economic activity that the facility and the use of local fuel brought to the community. The value-added impacts, or change in total personal and business income, varied from \$3.9 million to \$25.9 million for each county.

For a 40 MW power plant, output impacts ranged from \$10.7 million to \$78.7 million, employment impacts from 98 to 653 jobs, and value added

Box 1 – Understanding the Terms

Total output impacts—the effect on sales revenues of all businesses in a local economy resulting from the proposed change in industry activity.

Value added impacts—the effect on personal and business income in the local area.

Employment impacts—the effect on the total number of full-time, part-time and seasonal positions in the local area.

impacts from \$5 million to \$44.9 million. The large differences between these two counties were due to the fact that Orange County had local sources for purchase of the major capital items, while in Buncombe County some of these items had to be imported from other regions, representing leakage from the local economy.

Annual Operation Impacts

The economic impacts of annual operations in one year for power plants in each county are summarized in Table 3 (bottom). Total output impacts for the 20 MW plant ranged from \$12.8 million (Buncombe) to \$10.8 million (Orange). Employment impacts ranged from 242 for Buncombe to 177 jobs in Orange. Value added impacts ranged from \$7.59 million in Buncombe to \$6.91 million

in Orange. The impacts varied between the two counties due to differences in the local economies and to the greater wood-providing sector in Buncombe County.

For a 40 MW plant, total output ranged from \$26.65 million (Buncombe) to \$22.08 million (Orange). Employment impacts for Buncombe were 546 jobs and for Orange 393 jobs. The value added impacts for Buncombe were \$15.77 million and \$14.07 million for Orange. These results for plant operations would be permanent recurring annual impacts. The significant increase in jobs and value added for rural areas with high amounts of woody biofuel feedstock makes the 40 MW plant especially attractive for areas such as Buncombe County, but there are significant economic benefits from both sizes and in both rural and urban areas alike.

Table 4. Average employment creation projection by industry sector resulting from development of 20 or 40 MW Wood-Fueled Power Plants. Average is based on projections of 28 counties throughout the Southeastern US.

Aggregated Industry Sector	20 MW Plant		40 MW Plant	
	Jobs	Percent	Jobs	Percent
Agriculture, Forestry, Fisheries,	92	54.1%	226	61.2%
Mining	0	0.0%	0	0.0%
Utilities	1	0.5%	1	0.4%
Construction	4	2.4%	8	2.1%
Manufacturing	1	0.7%	2	0.6%
Wholesale Trade	2	1.0%	3	0.9%
Retail trade	10	5.9%	19	5.2%
Transportation & Warehousing	1	0.7%	2	0.6%
Information	1	0.4%	1	0.3%
Finance & Insurance	4	2.4%	7	1.9%
Real estate & rental	3	1.7%	5	1.4%
Professional- scientific & tech services	16	9.3%	27	7.2%
Management of companies	1	0.6%	1	0.4%
Administrative & waste services	4	2.4%	7	1.9%
Educational services	1	0.4%	1	0.3%
Health & social services	6	3.5%	12	3.1%
Arts- entertainment & recreation	1	0.5%	2	0.5%
Accommodation & food services	6	3.7%	12	3.2%
Other services	5	2.8%	9	2.6%
Government	12	6.8%	22	6.0%
Total	170	100.0%	370	100.0%

Sector Based Impacts

Often it is helpful to predict the distribution of economic impacts across various sectors of the local economy. The estimated average employment impacts of annual operations for a 20 MW and 40 MW power plant for 28 southeast communities are shown by major industry group in Table 4. For a 40 MW plant, a large employment impact, averaging 226 jobs (over 60 percent of all jobs) would occur in the agriculture and forestry sector that supplies wood fuel to these plants. There were also significant employment impacts in the sectors for professional services (27 jobs), retail trade (19 jobs), and government (22 jobs), reflecting the indirect and induced effects on the local economy.

Conclusions

Construction and operation of wood-fueled power plants have significant positive local economic impacts. But, as seen from the two

examples, these impacts could vary widely among counties, depending upon the proposed plant size and the amount of resources needed from outside the local economy. Wood fuel represents one of the largest expenditures for a power plant, and results in large impacts in the local forestry and forestry services sectors. Other sectors of the local economy are also impacted through supply chain purchases and employee spending. In the example above, economic impacts of a 40 MW power plant are greater than for a 20 MW plant, although not in proportion to the power output, due to economies of scale. One thing is clear, local economies vary in resources available within them. These variations make it imperative that communities seeking to develop wood-fueled power generation perform their own economic impact analysis to accurately estimate the positive economic impacts.

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